Impact of brown coal and biochar fertilizers on spring wheat productivity in the pot experiment

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The present work attempts to develop a method for the preparation of novel organo-mineral fertilizers with the use of brown coal and biochars as organic additives. Brown coal together with inorganic raw materials, which are used in urea superphosphate production, were granulated using two granulation methods: pan granulation and high shear granulation. Moreover, the coating process of urea superphosphate granules using three types of biochars was studied. The physico-chemical properties of the obtained organo-mineral fertilizers were investigated. The effect of brown coal based fertilizers and biochar coated fertilizers on spring wheat in pot experiments was evaluated.

Pot experiments

In 2018 and 2019, a greenhouse experiment was conducted to determine the effects of brown coal based fertilizers and biochar coated fertilisers compared to control, commercial fertilizer, and urea superphosphate (USP) on grain yield per plant, spike number per plant, and plant height of spring wheat cv. Varius. Wheat was grown in pots containing 7 kg of soil. Fertilizers were applied at a sowing by mixing fertilizer granules with soil. Fertilizer treatments were as follows: T_0 – control: 2.36 g MAP (NP 10-55), 3.7 g K_2SO_4, 10.4 g $(NH_4)_2SO_4$; T_1 – 11.48 g urea superphosphate (NP 21 – 9), 0.54 g KH_2PO_4, 3.35 g K_2SO_4; T_2 – 5.88 g commercial fertilizer (NPK(S) 6-12-34-(10), 1.09 g MAP, 9.33 g $(NH_4)SO_4$; T_3 – 25.06 g brown coal based fertilizer with ammonia (BC+USP+NH_3), 0.65 g KH_2PO_4, 3.29 g K_2SO_4; T_4 – 29.06 g brown coal based fertilizer with magnesite (BC+USP+M), 0.49 g KH_2PO_4, 3.39 g K_2SO_4; T_5 – 13.50 g medicinal plant biomass biochar coated urea superphosphate, 0.54 g KH_2PO_4, 3.35 g K_2SO_4; T_6 – 13.50 g energy-crop willow biochar coated urea superphosphate, 0.54 g KH_2PO_4, 3.35 g K_2SO_4; and T_7 – 13.50 g wood chips biochar coated urea superphosphate, 0.54 g KH_2PO_4, 3.35 g K_2SO_4. Each treatment has received the same dose of NPK (2.4 g N, 1.3 g P_2O_5, 2 g K_2O per a pot). Plants were watered to 60% field capacity. After harvest time determined the yield and yield components of spring wheat.

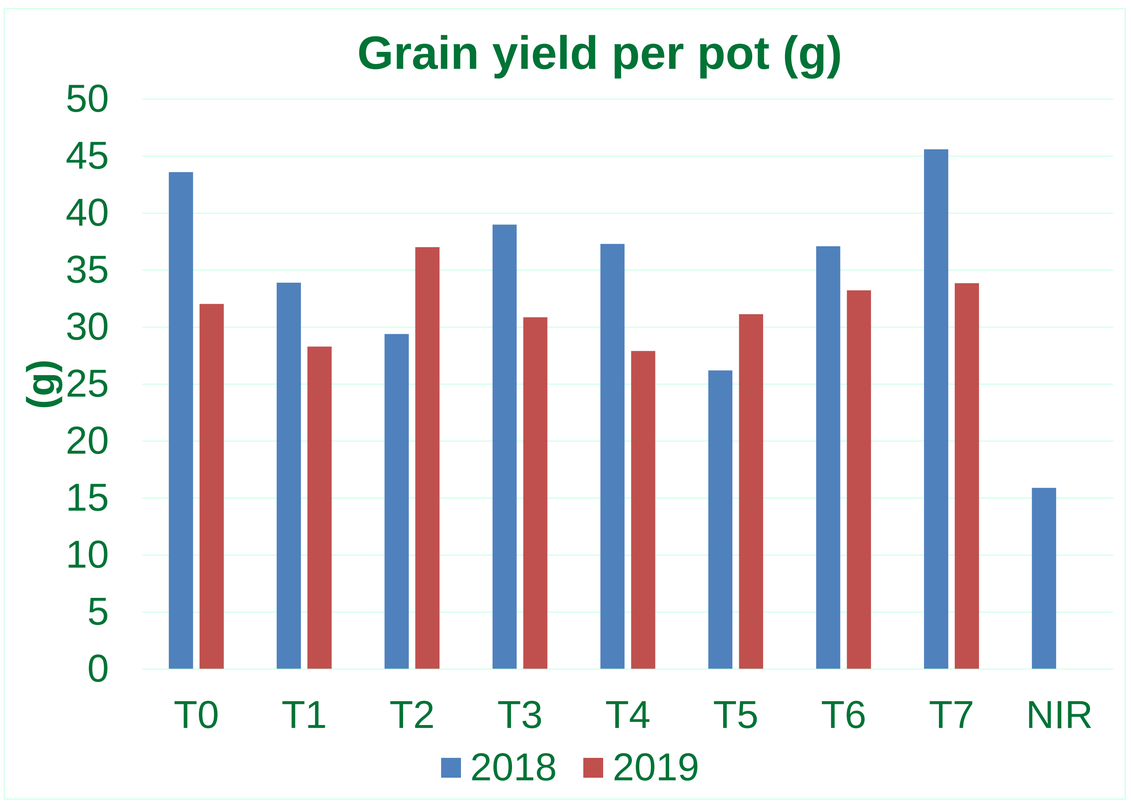

Figure 1. Grain yield of spring wheat in 2018 and 2019

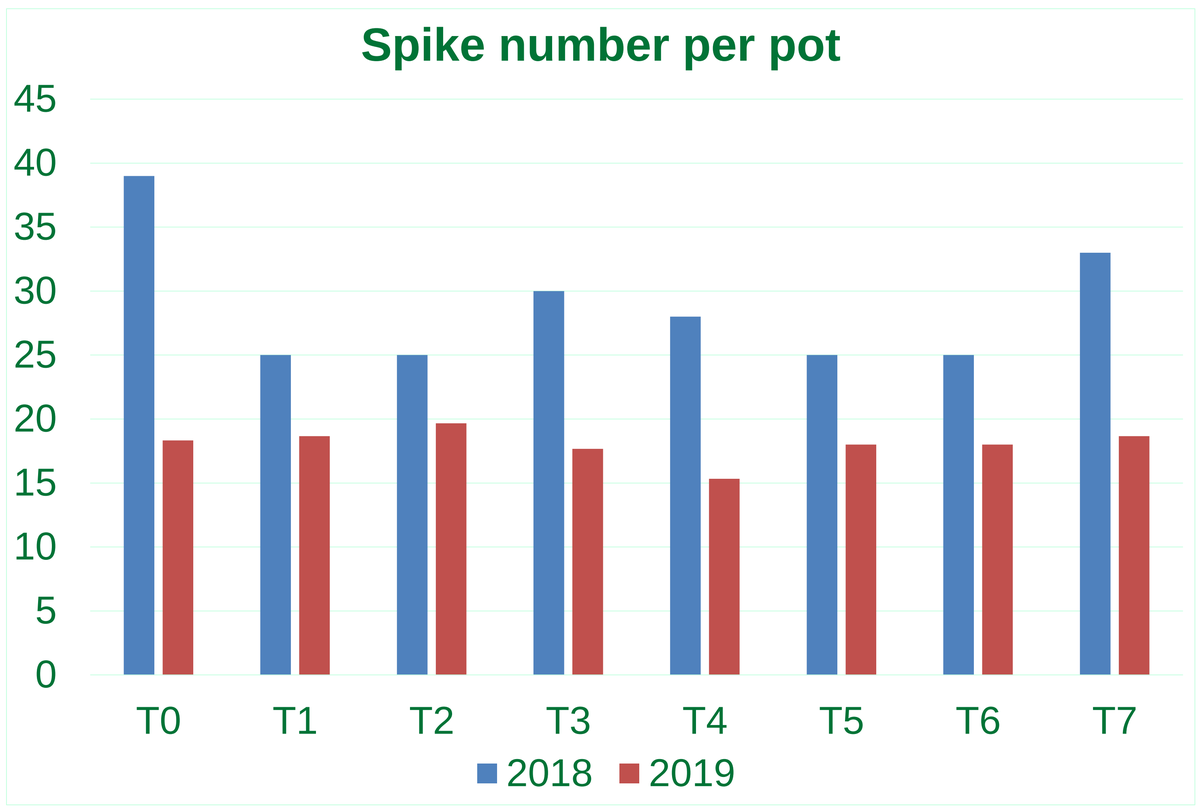

Figure 2. Number per spike of spring wheat in 2018 and 2019

Conclusions

Results from pot experiments in greenhouse showed that spring wheat responded positively to soil application of the brown coal based fertilizers and biochar coated fertilizers. The yielding results were statistically significant only in the first year of research, however, there was a tendency to positively influence both the addition of biochar and brown coal on yielding and the number per spike.

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